SYNCHROTRON EMISSION AT 6 AND 20 cm: VLA IMAGES AND 3–D MODELING OF THE JOVIAN RADIATION BELTS

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Abstract

High resolution radio–images of Jupiter's radiation belts at 6 and 20 cm were made using the Very Large Array (VLA) in 1997. While the 20 cm data have been widely exploited, the VLA images at 6 cm are presented for the first time.

We compare 6 and 20 cm images and east–west brightness distributions as a function of longitude. Furthermore, high latitude and equatorial intensity locations are compared at 6 and 20 cm. The results are then analyzed using the Salammbo–3D code. This first three–dimensional modeling (energy, pitch–angle, radial distance) of the Jovian radiation belts allows us to compute electron distribution functions everywhere in the inner radiation belts from the planet surface up to 6 Jovian radii, for electrons with energies between 100 keV and 300 MeV, and for all pitch–angles.

The synchrotron images deduced from the Salammbo 3–D model are compared with VLA observations at different longitudes and for the two wavelengths. The differences between 6 and 20 cm synchrotron emissions are discussed. We highlight the energy and pitch–angle resonances occurring near Amalthea's orbit. These resonances seem to play an important role in the formation of the observed high latitude intensities. They might explain the changes in shape of the radiation belts with wavelength.

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